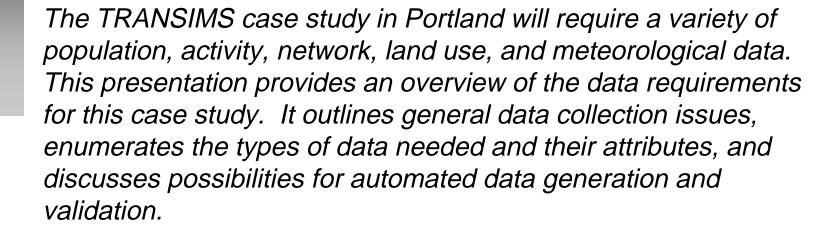
### Preliminary Data Requirements for IOC-2

D. Beckman, <u>B. Bush</u>, K. Nagel, P. Medvick, R. Smith, P.Stretz, M. Williams *Los Alamos National Laboratory* 22 July 1997

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### Abstract



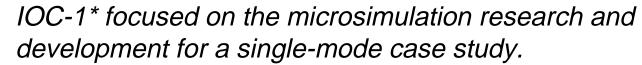
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# Outline overview general questions data preferences specific data

- network data
- population and activity data
- transit data
- freight data
- air-quality data
- measurements for calibration and validation
- generating missing data
- validating data sets
- proposal for data collection

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### Overview



- Detailed network data formats are available for IOC-1.
- No formal population, activity, or planning data specifications were developed for IOC-1.
- IOC-2 will focus on population, activity, and planning research and development for a multiple-mode case study.
  - The network data format specification will be revised to include the description of new modes.
  - Formal population, activity, and planning data specifications will be developed.

### Caveats:

- Research is still ongoing, so not all of our data needs are clearly defined and final specifications are not available yet.
- The case study has not been chosen yet.

<sup>\*</sup> IOC = interim operational capability

### General Questions

- Do you have comprehensive data catalogs that are easy for us to peruse?
- How difficult will it be to obtain data for local streets throughout the greater Portland region?
- Are you aware of methods . . .
  - to develop algorithms for generating missing data?
  - to develop tools for validating the consistency of data?
- How long will it take to collect the various types of data mentioned later in this presentation?
- Can you provide data formatted according to TRANSIMS specifications (when such specifications are available)?
- Is high-resolution aerial photography available in digital format?
- What is the general quality of the TIGER/Line data in the Portland area?

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### Data Preferences

The date (i.e., the year) for the network data should match the date used for population, transit, and other data. The age of data should be noted.

- Indications of data quality such as accuracy, completeness, and original source are valuable.
- The preferred measurement units are SI (meters, seconds, meters per second, etc.).
- The preferred geographic coordinate system is UTM (NAD 27).
- The preferred delivery formats are delimited text files, dBASE tables, ArcView shape files, and Arc/Info coverages.

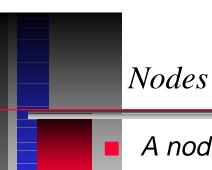
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### | |Network Data



- nodes
- links
- pocket lanes
- lane uses
- lane connectivity
- unsignalized intersections
- signalized intersections
- parking locations
- mode transfer locations
- mode crossing points
- We also need to know how network elements vary with time-ofday (e.g., phasing plans for traffic lights).
- It would be useful to know the TIGER/Line record id numbers corresponding to the various network elements.

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A node is a junction between links.

High-priority attributes:

- id number
- x coordinate
- y coordinate

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### Links



They may be streets, rail lines, bikeways, etc.

They are unidirectional.

High-priority attributes:

- id number
- name (e.g. street name)
- node id numbers for endpoints
- number of through lanes
- length (must not be shorter than straight-line map distance)
- grade
- capacity
- speed limit
- functional class (i.e, RTP designation)
- modes of travel and their means of separation
- toll

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### Links (continued)

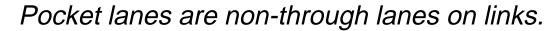


- "setbacks" at intersections
- "free-flow" speed
- "crawl" speed
- default "through" link at ending node
- id number of reverse link
- Estimates can be used for low-priority data attributes.

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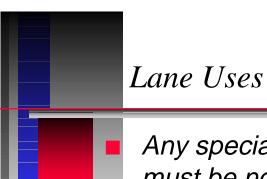
### Pocket Lanes



Low-priority attributes:

- link id number
- lane number
- position along link
- type (merge pocket, turn pocket, or pull-out), including on freeways
- length
- For parts of the network not critical to the case study, it might be possible to generate this data automatically, or omit it altogether.

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Any special lane uses (HOV lanes, restrictions on trucks, etc.) must be noted.

High-priority attributes:

- link number id
- lane number
- type of use

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### Lane Connectivity

- Lane connectivity specifies how lanes are connected across a node.
- High-priority attributes:
  - prohibited turns
- Low-priority attributes:
  - node id number
  - table of which incoming lanes connect to which outgoing lanes
  - turn penalties
- We have algorithms to generate this data automatically where it is not available.

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Unsignalized intersections have sign controls (as opposed to having traffic lights).

All nodes are either unsignalized or signalized.

Low-priority attributes:

- node id number
- the sign on each incoming link at each intersection (stop, yield, or none)
- Given general rules for placing signs at intersections, it is possible to generate this data automatically where it is not available, provided at least one "through" direction is given.

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### Signalized Intersections

Signalized intersections have a traffic light.

High-priority attributes:

- node id number
- type of signal (pre-timed)
- Medium-priority attributes:
  - phasing plan (which movements are allowed in each phase and how they are protected)
  - timing plan (how long the phases last and how they are sequenced)
  - timing offsets
- We are interested in developing algorithms that can generate the medium-priority attributes from the characteristics of the incoming links, such as impedances or capacities.
- We might develop microsimulation techniques that do not require the low-priority attributes to be specified at all.

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### Parking Locations

Parking areas are located along links.

They may represent actual driveways or parking places, or be generic.

- Low-priority attributes:
  - id number
  - link id number
  - position along link
  - type (parallel on street, head-in on street, driveway, parking lot entrance, or generic)
  - capacity
  - pricing
- For regions of the network not critical to the case study, it will be possible to generate this data automatically.
- Major centers of production or attraction may require extra detail.

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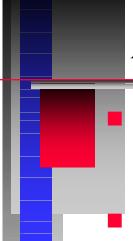
### Mode Transfer Points



High-priority attributes:

- id number
- beginning and ending modes
- beginning and ending link numbers
- Low-priority attributes:
  - name
  - positions along beginning and ending links
  - time delays (including walking times in stations)
  - capacity
  - pricing
- Estimates can be used for low-priority data attributes.

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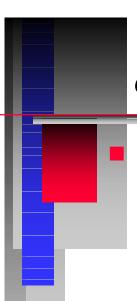
### Mode Crossing Points

Mode crossings are where a link of one mode crosses (and interferes with) a link of a different mode, but where there is no opportunity for travelers to change their mode of travel.

High-priority attributes:

- link id numbers for the modes
- positions along links where the crossing occurs
- type of interference
- time delays
- right-of-way

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### Other Network Elements

Depending on the case study chosen, several other network data elements might be modeled in IOC-2:

- roadway traffic sensors
- actuated traffic signals
- wide-area traffic controls
- ITS technology
- anything that significantly slows down dynamics of cars, trains, bicycles, pedestrians, etc. (e.g., speed bumps, pedestrian crossings)

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### Population and Activity Data

- map of traffic analysis zones
- population location and demographics
- activities and surveys of activities
- tours
- mode choice information
- trip tables
  - household trips
  - taxis
  - freight
- land use
  - attractors (e.g., local businesses\*)
  - producers

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<sup>\*</sup> Would commercially-available business directories be useful here?

### Population and Activity Data (continued)



- registered street address
- vehicle age and type
- non-vehicular modes (i.e., bicycle and pedestrian)
- any special Census Bureau or other data sets not publicly available

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### Transit Data



- routes
- schedules
- vehicles
- We have not yet determined at what resolution/fidelity we will simulate transit.

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### Transit Routes A transit route

A transit route is the path a transit vehicle takes in the network. High-priority attributes:

- id number
- name
- mode
- sequence of link id numbers

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## Transit Schedules

A transit schedule tells when an individual transit vehicle arrives at each point on its route.

High-priority attributes:

- route number
- stop locations
- headways
- dwell times
- layovers
- vehicle
- pricing
- time control points
- We also need information on operational rules and procedures (e.g., what do buses do when the get behind schedule or fill to capacity).
- Riderships surveys would be useful, if available.

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## Transit Vehicles

A transit vehicle carries travelers along a transit route.

High-priority attributes:

- type of vehicle (bus, train, etc.)
- capacity (sitting and standing)
- age
- technology

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### Freight Data O-D matrices for freight representation in trip tables freight routes

- roads with freight restrictions
- heavy freight vs. light commercial
- truck fleet composition

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### Air Quality Data

- emission inventories for point sources and non-transportation activities
- upper-air data (probably from the airport)
- previous short-term air quality studies
- inputs to airshed models
  - land use
  - emissions
- sources of data (e.g., State of Oregon, Department of Environmental Quality, Air Quality Division, EPA, University researchers, and the National Climatic Data Center?)

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### Measurements for Calibration and Validation

turn counts

traffic volumes

chase car and instrumented vehicle studies

road sensor data

■ transit performance (e.g., delays from schedule)

intersection capacities or impedances

air monitoring data

videotape

other

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It is possible to generate automatically data that is too expensive or difficult to collect.

In IOC-1, we estimated several types of data:

- parking locations
- "through" links at intersections
- lane connectivity
- signs at unsignalized intersections
- Additional capabilities would be useful for IOC-2:
  - local street properties
  - road grades
  - pocket lane locations
  - intersection geometry
  - signalized intersection locations, phasing plans, timing plans, and timing offsets
  - mode transfer locations

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The TRANSIMS planner and microsimulation require consistent and realistic input data.

Planning networks generally are not adequate for microsimulation. (IOC-1 required enhancements to freeways, local streets, and major production/attraction areas.)

- We have already developed procedures for identifying data problems:
  - data field values
  - cross-references between id numbers in files
  - network topology (connectivity, dead-ends, etc.)
  - lane connectivity
  - allowed movements at intersection controls
  - phasing and timing plans for signals
  - lengths vs. Euclidean distances
- Automated methods of checking IOC-2 data also need to be developed.

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### Proposal for Data Collection

- 1. Determine the availability of the data mentioned in this presentation.
- 2. Obtain raw data (i.e., data in any usable format) of interest for research purposes.
- 3. Continue LANL population, activity, planner, and microsimulation research for IOC-2.
- 4. Team up with organizations to develop techniques for generating missing data and for validating data sets.
- 5. Finalize IOC-2 data format specifications.
- 6. Receive final data for case study in IOC-2 format.
- 7. Perform Portland case study.

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